

root of each twisted branch is then heated to shunt the twist, thereby reforming the twisted and untwisted portions of the wire into a continuous piece of branched wire. Next, thermocouples are formed by joining one end of each positive lead wire to the tip of one of the twisted branches and the

other end to one of the output terminals. If the number of thermocouples formed in this way is  $N$ , then there are only  $N + 1$  lead wires (the one common negative wire and  $N$  positive wires) and an equal number of terminals.

*This work was done by Jon C. Goldsby of Glenn Research Center. Further*

*information is contained in a TSP (see page 1).*

*Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17181.*

## Zipper Connectors for Flexible Electronic Circuits

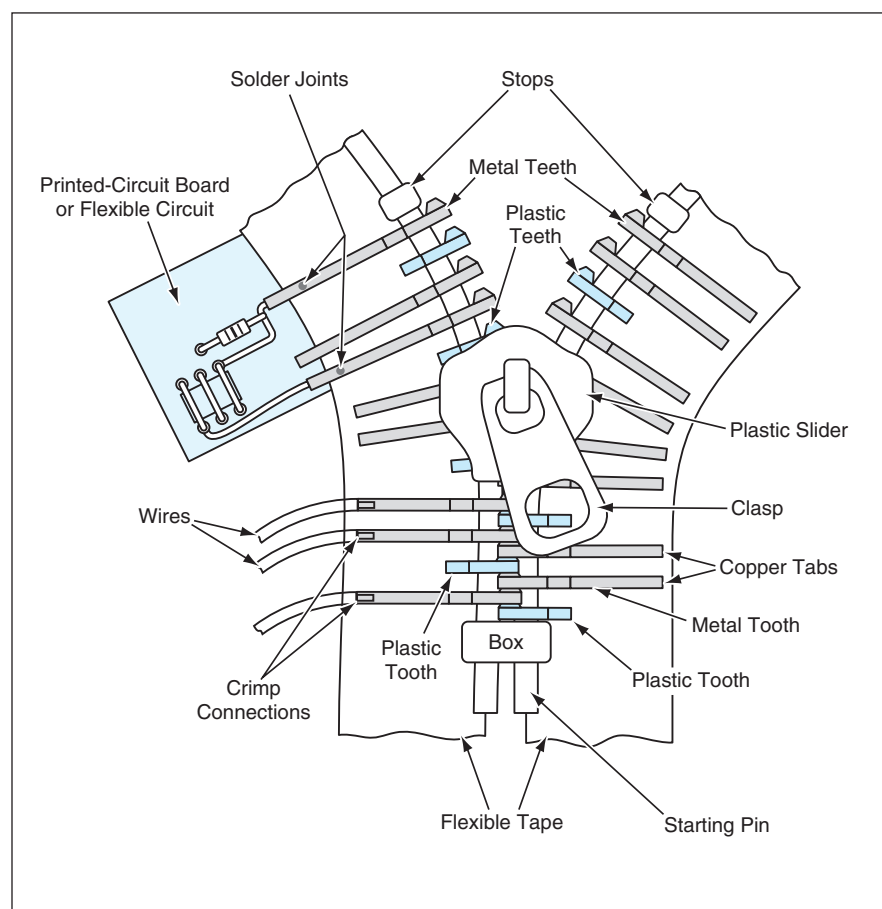
**Circuits could be connected and disconnected quickly and easily.**

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Devices that look and function much like conventional zippers on clothing have been proposed as connectors for flexible electronic circuits. Heretofore, flexible electronic circuits have commonly included rigid connectors like those of conventional rigid electronic circuits. The proposed zipper connectors would make it possible to connect and disconnect flexible circuits quickly and easily. Moreover, the flexibility of zipper connectors would make them more (relative to rigid connectors) compatible with flexible circuits, so that the advantages of flexible circuitry could be realized more fully.

Like a conventional zipper, a zipper according to the proposal would include teeth anchored on flexible tapes, a slider with a loosely attached clasp, a box at one end of the rows of mating teeth, and stops at the opposite ends (see figure). The tapes would be made of a plastic or other dielectric material. On each of the two mating sides of the zipper, metal teeth would alternate with dielectric (plastic) teeth, there being two metal teeth for each plastic one. When the zipper was closed, each metal tooth from one side would be in mechanical and electrical contact with a designated metal tooth from the other side, and these mating metal teeth would be electrically insulated from the next pair of mating metal teeth by an intervening plastic tooth. The metal teeth would be soldered or crimped to copper tabs. Wires or other conductors connected to electronic circuits would be soldered or crimped to the ends of the tabs opposite the teeth.

The pitch (that is, the distance along the zipper between mating pairs of metal teeth) would be a major consideration in design. It has been esti-



**A Zipper Connector** for electronic circuitry would resemble a conventional clothing zipper in several respects.

mated that a pitch of 100 mils ( $\approx 2.5$  mm) can be achieved by known fabrication techniques and that pitches as small as 25 mils ( $\approx 0.6$  mm) may eventually be achievable. Problems that remain to be solved include how to prevent short-circuiting of exposed teeth in contact with external electrically conductive objects and how to prevent corrosion of the teeth. The short-circuiting problem could be solved by adding a dielectric flap that would

cover the teeth. The corrosion problem might be solved by use of gold contacts; the other option would be to add a water-tight seal, but such a seal could reduce or eliminate the advantage of quick and easy connection and disconnection.

*This work was done by Kevin N. Barnes of Langley Research Center. Further information is contained in a TSP (see page 1). LAR-16320*